PATENT SPECIFICATION

443,934

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COMPLETE SPECIFICATION

Improvements in or relating to Slides for Microscopes and other Image Creating Optical Devices

We, HARRY GLENN OTT, a citizen of the United States of America, and THE SPENCER LENS CO., a corporation organised under the laws of the State of New York, United States of America, both of 19, Doat Street, Buffalo, New York, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following statement:—

This invention relates to slides for microscopes and other image creating optical devices, and particularly to those utilising transparent material, upon which reference markings may be placed. Examples of such slides are reticles, and slides or counting chambers for microscopes, especially those known as haemocytometers, which have reference lines which define a pattern or zones or areas on a face thereof. Heretofore it has been difficult to rule uncoated glass or other transparent objects with lines as fine as are frequently required and always have the lines distinctly visible under a microscope. With the best of such lines, as heretofore made, it has been necessary to diaphragm the condenser, or stop it down, to such an extent that the effectiveness of the instrument is seriously impaired for observation of details, such as of blood dilutions, before the reference lines could be made clearly and distinctly visible.

An object of this invention is to provide a slide for microscopes and other image creating optical devices utilizing a transparent body with very fine reference lines thereon that will be easily and distinctly visible when viewed in the optical system of the optical device without diaphragming the condenser or stopping it down, or otherwise interfering with the maximum possible visibility of the image in said system of the optical device.

Another object of the invention is to provide an improved method for placing reference coatings and lines on transparent slides for use in optical systems.

[*Price* 1/-]

Another object of the invention is to provide a transparent slide with a semi-transparent coating which will be fixed thereto sufficiently to resist cleansing actions that may be performed on the body.

Still another object of the invention is to provide an improved slide, such as a counting chamber, slide or a haemocytometer, which will have on a face thereof lines of maximum visibility and distinctness, and which will be relatively simple, practical and accurate.

A further object of the invention is to provide an improved transparent slide, and method of making the same, which will have a semi-transparent coating on a face thereof that is substantially inert to most substances that may be applied to the coated article.

Thus according to the present invention there is provided a slide for a microscope or other image creating optical device comprising a body of transparent material having a semi-transparent coating upon a face thereof and sub-divided by lines of a different degree of transparency into selected areas.

Further according to the present invention there is provided a slide for a microscope or other image creating optical device comprising a body of transparent material having, upon a face thereof, a semi-transparent coating producing a contrasting background, and having a line-like strip of a different degree of transparency crossing said background.

The invention further comprises a slide for a microscope or other image creating optical device comprising a body of transparent material having a semi-transparent coating fixed to a face thereof, and divided by uncoated lines of microscopic size into selected zones delineating a predetermined pattern, whereby when the zone of the coated face is under magnification, said lines defining that zone will be clearly visible.

There is provided according to another

feature of the invention a slide for a microscope or other image creating optical device comprising a body of transparent material having upon portions of a face thereof, a semi-transparent coating, which with the uncoated portions of the face provides a plurality of contrasting zones with one group of zones separated by narrow lines of the other contrasting zones.

According to yet another feature of the invention there is provided a hæmocytometer slide comprising a glass body having upon a face thereof, a semi-transparent metallic coating with reference lines ruled into said coating, whereby in the use of the slide, the corpuscles are distributed more evenly over the metallic coating.

Various other objects and advantages will be apparent from the following description of an embodiment of the invention, and the novel features will be particularly pointed out hereinafter in connection with the appended claims.

In the accompanying drawing:

Fig. 1 is a plan view of a slide, such as a counting slide or hæmocytometer, constructed in accordance with this invention;

Fig. 2 is a side elevation of the same, but with a cover glass applied thereto, and a solution in position between the cover glass and the ruled surface of the slide;

Fig. 3 is a plan of a portion of the ruled face of such a slide, on a highly magnified scale;

Fig. 4 is a sectional elevation of the same with the section taken approximately along the line 4—4, of Fig. 3; and

Fig. 5 is a sectional elevation of a simple conventional apparatus to illustrate one manner in which a metal may be deposited on a glass plate as a semi-transparent layer by the sputtering of the metal from a cathode in a glow discharge device.

In accordance with this invention, the slide which has been selected to show an embodiment or example of the invention, is a microscope or hæmocytometer comprising a plate 10 of glass having spaced, elevated ribs 11 upon a face thereof. The ribs 11 serve to support the usual cover glass A.

Between these ribs 11 is a broad, raised section 12 that is of slightly less height than the ribs 11. The upper or end face of this elevated section 12 is preferably given its final finish such as by fine grinding or polishing, and then the lines subdividing a selected portion of this face into selected areas are formed or placed thereon. In the particular example illustrated, a groove 13 subdivides the face 12 into two sections, each of which has a subdivided face area but it will be understood that this groove 13 is not essential and that one or any number of subdivided areas may be provided on a slide.

According to one very satisfactory method of forming the reference lines upon such a plate or slide, the plate 10 is supported in a suitable manner inside a sealed chamber 14, Fig. 5, such as under a bell jar 15 which is removably sealed to a base 16. A cathode 17, which may conveniently be in the form of a metal plate 17, is supported in the chamber 14 by a conductor 18 which passes outwardly through a sealed passage in the bell jar 15, the cathode or plate 17 being disposed just above the plate 10. An electrode 19 is provided in the lower part of the chamber 14 at the opposite side of the plate 10 from the plate 17, and this electrode is included in an electric circuit by means of a conductor 20 which passes out through the base 16.

A conduit 21 opens into the chamber 14 through the base 16 and this, in turn, is connected to a suitable vacuum creating device 22, such as a vacuum pump or other vacuum producing device. The chamber 14, the cathode 17, and the electrode 19 form a glow discharge tube or device so that when a suitable electric current is applied to the conductors 18 and 20 while there is a partial vacuum in the chamber 14, there will be a glow discharge between the electrode 19 and the cathode 17. During this glow discharge, there will be a sputtering or discharge of fine or colloidal particles of the metal from the cathode 17, and the metallic particles so thrown off by the cathode 17 will be deposited upon the plate 10 in the form of a layer or coating 23, the density of which may be regulated to some extent in a manner well known in the art, such as by duration of the operation or by regulation of the current.

The coating 23 applied in this manner is semi-transparent because a thin coating can be obtained owing to the fact that the metallic particles so deposited upon the plate are colloidal in nature and are little more than molecules of the metal which have been thrown off by the cathode and caught by the plate.

After the plate 10 has been coated in this manner, it is removed and subjected to a ruling or cutting operation by which the coating 23 is removed in narrow strips forming lines 24, as shown

in Figs. 3 and 4. The lines thus formed on the plate may be made extremely fine or narrow, due to the thinness of the coating or layer of the metal. While this metallic coating is quite adherent to the plate of glass, it is important that the coating be fixed to the plate as firmly as possible, so that in subsequent cleaning operations to which the plate may be subjected after use, none of the coating will be removed and cause obliteration or destruction of the fine lines.

Any suitable manner of fixing such a coating to the plate may be employed, but one very satisfactory method of fixing the coating is by a process known as "burning in" which consists of heating the coated plate to a suitable temperature which is usually less than the softening or fusing point of either the coating or the plate. For example, when the plate is of glass and the metal is platinum, we have found that heating the coated plate to a temperature of approximately 900°F. is sufficient to fix the coating to the glass very satisfactorily.

During the heating of the coated plate to this high temperature to burn or fix the coating to the plate, the nature of the exact change which occurs is not definitely known, but is believed to be due to a greater physical attraction between the molecules of metal and the molecules of glass which have increased their amplitude of vibration during the increase in temperature. After the coated plate has been heated to the desired extent to fix the coating to the plate, the article is allowed to cool and is then ready for use. During use, such an article may be rubbed and cleansed freely without danger of any material removal of the coating.

The lines 24, which are merely narrow strips of higher transparency than the coated sections, may be very fine lines and yet be very clearly and distinctly visible, and we have found that they are distinctly visible under all conditions of use under a microscope. For example, it is unnecessary to diaphragm or stop down the condenser and shut out light in order to increase the visibility of such lines, and, therefore, one may very easily set the microscope to give maximum visibility of the lines at the same time that maximum visibility of the details of the solution on the slide is obtained. When the slide is used as a hæmocytometer, it is possible to have full visibility of the lines at the same time that the details of the blood dilution are fully and clearly visible.

Substances such as silicon or any metal may be employed as the cathode, and the coating of course will be of the material of the cathode. Usually it is preferable to use those metals or materials which are inert to the solutions being examined, and for that purpose platinum, gold and silver are particularly valuable, yet such slides are inexpensive because of the very minute amount of metal which is deposited upon each plate or slide.

It is also possible to provide this semi-transparent coating by other means. For example, the chemical process of depositing silver or other metals on mirrors or glass plates may be adopted for this purpose. Various other means for depositing metal coatings on objects may also be employed.

Some opaque substances, such as chromium, do not sputter well in a glow tube or device, but those substances, including chromium and all other metals can be applied as a semi-transparent coating of any desired density by what is known in the art as the distillation process. That process includes coating or plating a conductor, such as a tungsten wire, with the metal or other materials of which the coating is to be made, and the coated conductor is then supported above or in proximity to the face to be coated. A partial vacuum is created around the coated conductor and the member to be coated, and the conductor then heated, such as by an electric current. The metal or coating material on the conductor is, in effect, distilled off in very fine particles or vapor, and is deposited, or collects, on the adjacent face of the transparent body or plate. This process is continued until the coating has the desired density or degree of transparency.

Opaque substances may be deposited on glass from colloidal suspension by reduction of a metallic compound to the metallic state with subsequent heating and absorption of the deposit by the glass.

One example of such deposition is as follows: One part of neutral Platinic Chloride, prepared by evaporating a ten per cent solution to dryness is moistened by a few drops of absolute alcohol and ground finely in an iced mortar with ten or more parts of lavender oil, added gradually in small quantities. This suspension is applied on a very thin film to the slightly warmed glass surface. The glass at first is heated carefully to drive off the volatile matter, and then at a low red heat to burn the carbonaceous material and fuse the platinum onto the glass surface.

This layer may be fixed to the plate in any suitable manner, such as by "burning in". It will be understood, however, that while the colloidal substance is opaque, it provides a semi-transparent layer or coating by reason of its colloidal form and the extent of dilution of the suspending medium. After a plate has been coated according to any of these other methods above described, the lines are formed by removing a part of the coating. This removal may be carried out either before or after the fixing of the coating to the transparent body or plate.

In forming the lines by the removal of a part of the coating, one may remove only narrow strips of coating to form fine lines free of coating that define the boundaries of reference zones on the coated areas, or one may remove coated areas to leave fine reference lines of the coating extending across the previously coated area and defining reference zones thereon. By either method of forming the lines, it is possible to obtain either lines of full transparency on a semi-transparent background, or semi-transparent lines on a fully transparent background, depending upon the uses to which the slide is to be put. The coated and uncoated areas provide contrasting areas or zones, yet there is considerable transparency in both coated and uncoated areas which will not seriously interfere with the passage of light through this optical article.

It will be understood that the apparatus for applying the layer of metal to the plate by sputtering is shown schematically and described only briefly in order to illustrate the principle employed, and other apparatus suitable and well known for this purpose may be substituted and used within the scope of this invention. It will also be understood that while the slide which has been illustrated and described is a microscope slide or counting chamber, such as a hæmocytometer, the invention is also applicable, in its broader aspects, to other optical devices with an optical system to erect images and utilizing reference lines on a transparent body.

It will be understood that the lines or narrow strips free of coating are relatively small or narrow and in the claims where we have referred to the lines or strips as being of microscopic size, we intend to refer to lines which are of a size that are not easily distinguished and defined when viewed under the naked eye but which become easily visible when they are closely examined or magnified to some extent.

It will be further understood that various other changes in the details which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention as expressed in the appended claims.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A slide for a microscope or other image creating optical device comprising a body of transparent material having a semi-transparent coating upon a face thereof and sub-divided, by lines of a different degree of transparency into selected areas.

2. A slide for a microscope or other image creating optical device comprising a body of transparent material having, upon a face thereof, a semi-transparent coating producing a contrasting background, and having a line-like strip of a different degree of transparency crossing said background.

3. A slide for a microscope or other image creating optical device comprising a body of transparent material having a semi-transparent coating fixed to a face thereof, and divided by uncoated lines of microscopic size into selected zones delineating a predetermined pattern, whereby when the zone of the coated face is under magnification, said lines defining that zone will be clearly visible.

4. A slide for a microscope or other image creating optical device comprising a body of transparent material having upon portions of a face thereof, a semi-transparent coating, which with the uncoated portions of the face provides a plurality of contrasting zones with one group of zones separated by narrow lines of the other contrasting zones.

5. A microscope slide according to any one of the preceding claims, in which the coating is metallic and is burnt into a face of the slide.

6. A microscope slide according to any one of the preceding claims, in which the coating consists of a mixture of an opaque substance in colloidal form which will not volatilize at burning temperatures, and a volatile suspension medium for said substance.

7. A microscope slide according to any one of the preceding claims, in which the semi-transparent coating is of deposited metal, fixed to a face of the

slide to prevent substantial removal of any part of the coating by cleansing operations.

8. The process of preparing a microscope slide which comprises the steps of applying to or depositing upon a face of a transparent body or glass plate, a semi-transparent coating, and removing part of said coating to delineate specified areas or to provide lines of contrasting transparency crossing said face in the portion of said face to which the coating was applied.

9. The process of preparing a microscope slide according to claim 8, which comprises applying a semi-transparent coating of an opaque colloidal substance, and fixing said coating to the face of the transparent material to resist cleansing operations on said body.

10. The process of preparing a microscope slide which comprises the steps of depositing, upon a face of a body of transparent material or glass plate, a semi-transparent coating of an opaque substance or metal by sputtering from a cathode of that substance or metal, and then removing portions of said coating to provide areas of one degree of transparency defined by areas of a different degree of transparency.

11. The process according to claim 8, 9 or 10, which comprises the step of burning in said coating.

12. The process of making a counting slide for microscopes according to claims 8 to 11, which comprises heating the coated plate to a temperature of approximately 900°F. to fix the coating to the plate.

13. A device for counting visible bodies suspended in a fluid and magnified in an optical system which comprises a plate of transparent material having upon the specimen-supporting face thereof, a semi-transparent, adherent coating of an opaque substance, having zones thereof sharply defined by lines of a different degree of transparency.

14. Process of preparing a microscope slide according to claim 8, which comprises applying the semi-transparent coating by a distillation process, which includes coating or plating a conductor with a metal or other material of which the coating is to be made, supporting the coated conductor in proximity to the face of the transparent plate, creating a partial vacuum around the conductor and the plate, and heating the conductor as by an electric current.

15. A hæmocytometer slide comprising a glass body having upon a face thereof, a semi-transparent metallic coating with reference lines ruled into said coating, whereby in the use of the slide, the corpuscles are distributed more evenly over the metallic coating.

16. Process of preparing a microscope slide or counting device for microscopes substantially as hereinbefore described.

Dated the 2nd day of March, 1935.
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Fig. 1.

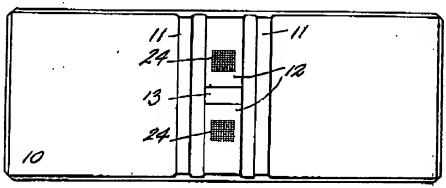


Fig. 2.

Fig. 4.

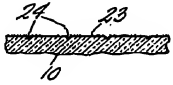
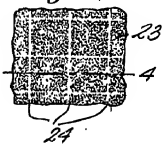


Fig. 5.

Fig. 3.



[This Drawing is a reproduction of the Original on a reduced scale.]

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